SENSITIVE SUBJECTS LIST

The Sensitive Subjects List (SSL) is a compilation of technical subject matter or technologies that is intended to aid the Department of Energy (DOE)-complex in identifying "sensitive" information. The list identifies subjects related to the development and production of weapons of mass destruction (nuclear, chemical, and biological) and their delivery systems (including missiles), conventional weapons, and other technologies deemed significant to the national security of the United States. The SSL is an internal DOE document that is not used outside of the DOE-complex. It does NOT replace or supercede U.S. export control regulations as outlined in Part VII of this list.

DOE hosts of foreign visitors, DOE foreign travelers, and others holding information on these subjects should be aware of all constraints on releasing information.[1] Caution should be exercised in providing gratuitous information or releasing information prematurely regarding rapid advances or breakthroughs in technology. Similar precautions apply to information regarding supporting technologies, such as information embedded in another technology (e.g., advanced control systems incorporated into military equipment). Any potential transfer of information that was once controlled as Applied Technology or classified as Restricted Data (RD), including Unclassified Controlled Nuclear Information (UCNI), and any security related information should be carefully reviewed and the specific approvals of the appropriate authorities obtained prior to transfer. (Authorization procedures vary across the DOE complex. Consult the security officer at your site for specific guidance regarding these procedures).

Prior issuance of a U.S. export license or documented license exception/exemption always is required before any export-controlled information may be released to a foreign national. In addition, the Office of Counterintelligence must conduct an "indices" check on foreign nationals from sensitive countries and those who visit or are assigned to a site where they will gain access to sensitive information.

Part I: Topics Related to Nuclear Weapons and Nuclear Fuel Cycle

The following subject areas and related technologies may contain "sensitive" information. Such information may pertain to the research, design, development, testing, manufacture, production, or use of items below and their associated processes, materials, equipment, components, parts, accessories, and software. The lists provided are *illustrative* only and should *not* be considered exhaustive. Additional information regarding these subject areas can be found in the Department of Commerce Export Administration Regulations (15 CFR Parts 730-774), the Nuclear Regulatory Commission regulations (10 CFR Part 110), the Department of Energy regulations (10 CFR Part 810), and the Department of State International Traffic in Arms Regulations (22 CFR Parts 120-130).

Nuclear Weapon Development and Testing

1. Nuclear weapons and weapon technologies, *for example*:
a) high explosives relevant to nuclear weapons,
b) detonator design or explosive-train initiation systems and firing sets and their components [e.g., switching devices (krytrons, sprytrons, and triggered spark gaps), and low inductance capacitors],
c) neutron generator technology for alpha-n and accelerator type generators (e.g., generator target fabrication and seals technology),

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[1] The DOE Glossary defines information as any communication or reception of knowledge such as facts, data, or opinions including textual, numerical, graphic, cartographic, narrative or audiovisual forms, whether oral or maintained in any medium, including computerized databases, paper, microform, or magnetic tape.

d) weapon component fabrication (e.g., computer-aided design and manufacture, high-accuracy machine tools, furnaces, and isostatic presses) and manufacturing process enhancements,
e) generally any nuclear weapon-related technology or weapon-specific details,
f) surveillance and sensor technologies that are critical and unique to surveil nuclear weapon stewardship or development,
g) information relating to Stockpile Life Extension Program (SLEP) and SLEP planning that would enhance another nation's understanding of U.S. weapons and/or the status of the U.S. stockpile.

2. Nuclear weapons materials properties if not already adequately protected by classification guidance, *for example*:
a) material databases of critical and unique use to nuclear weapon stewardship or development,
b) nuclear cross sections of primary use in weapons,
c) plutonium databases and simulation technologies applicable primarily to weapons,
d) opacity and equation of state models and information critical and unique to weapon design.

3. Experiments on dynamic or energetic materials designed to benchmark the performance or safety of integrated nuclear weapon systems, weapon system components, or weapon materials or surrogates, and the instruments, facilities, infrastructure, software or other capability needed to design or field the experiments, collect the data, or analyze the results, *for example*:
a) subcritical nuclear, hypervelocity, or hydrodynamic tests and associated diagnostics;
b) flash x-ray and proton radiography facilities (e.g., DARHT, PHERMEX, FXR, and AHF) and associated technology (e.g., x-ray conversion, advanced containment/confinement, scatter-reduction, magnetic focusing, etc.);
c) experiments on ejecta, friction, mix, or shock propogation;
d) specialized instrumentation and diagnostics for fast transient events, such as high-speed oscilloscopes, pulse generators, framing or streak cameras, gamma cameras, or "gatable" image intensifiers.

4. Nuclear weapon test detection and archives; and nuclear weapon effects information, *for example*:
a) unclassified data, models, or information that support the identification or detection of a clandestine nuclear explosion whose release would reveal U.S. capabilities or limitations to identify or detect such explosions;
b) experimental methods, tests, or calculations of nuclear weapons effects that could be used to understand vulnerabilities to U.S. defense systems or weapons;
c) information about nuclear weapons effects that substantially increase the military effectiveness of U.S. weapons.

5. High-energy-density physics research relating to nuclear weapons, *for example:*
a) inertial confinement fusion experiments and supporting equipment, such as
   1) high-energy short-pulse laser technology,
   2) cryogenic technology,
   3) microballoon fabrication technology (shells of glass and other materials a few microns in diameter),
b) pulsed-power experiments and supporting equipment (such as high-energy capacitors and spark-gap switches).

<u>Nuclear Fuel Cycle Activities</u>

6. Isotope separation for uranium, plutonium, and other fissile materials, *for example*:
a) gaseous diffusion,
b) gas centrifuge,
c) aerodynamic,
d) chemical exchange,
e) ion exchange,
f) electromagnetic,
g) laser isotope separation, including Atomic Vapor Laser Isotope Separation (AVLIS), Molecular Laser Isotope Separation (MLIS), Separation of Isotopes by Laser Excitation (SILEX), and Chemical Reaction by Isotope Selective Laser Activation (CRISLA); and laser systems that could be used in such processes,

h) plasma separation processes (PSP) such as those based on ion cyclotron resonance.

7. Nuclear reactor systems, sub-systems, and associated technologies, *for example*:
a) naval, mobile/portable military, space, research, production, or power reactors;
b) critical assemblies;
c) simulators.

8. Chemical conversion, handling, and storage of uranium, plutonium, other fissile and source materials, and associated compounds, *for example*:
a) uranium oxide, tetrafluoride, hexafluoride, tetrachloride, or metal;
b) plutonium oxide, tetrafluoride, hexafluoride, or metal;
c) Mixed Oxide Fuel (MOX).

9. Metallurgy of fissile and source materials including but not limited to natural or depleted uranium, thorium, americium, ^{233}U, ^{235}U, ^{239}Pu, or ^{237}Np.

10. Fuel-element and target fabrication, *for example*:
a) powder handling, including compaction and sintering techniques,
b) ceramic or metal fabrication,
c) fuel/target encapsulation.

11. Chemical processing of irradiated nuclear material, *for example*:
a) solvent extraction (e.g., PUREX, BUTEX, TRUEX);
b) electrorefining;
c) ion exchange;
d) precipitation;
e) pyroprocessing;
f) other partitioning techniques.

12. Analytical instruments for use in Nuclear Fuel Cycle Activities (Items 6-11), including, but not limited to, mass spectrometers capable of measuring isotope ratios of source and special nuclear materials.

13. Software for the design, analysis, production or use of equipment, systems or facilities engaged in Nuclear Fuel Cycle Activities (Items 6-12).

Nuclear-Related Material Production and Safeguards

14. Tritium production technology, *for example*:
a) target design and fabrication,
b) recovery processes and chemistry,
c) tritium-gas handling procedures,
d) storage and packaging: gaseous and solid state.

15. Accelerator-driven systems and sub-systems for the production of tritium or special nuclear materials.

16. Lithium isotope separation, *for example:*
a) mercury-based chemical exchange processes, such as the Column Exchange (COLEX) process;
b) ion exchange separation processes including displacement band chromatography;
c) crown ether, cryptand, and lariat ether separation processes;
d) plasma separation processes (PSP) such as those based on ion cyclotron resonance;
e) fused or molten salt electromigration processes.

17. Heavy water or deuterium (and compounds thereof) production, *for example:*
a) water-hydrogen sulfide exchange (e.g., the Girdler-Sulfide process),
b) ammonia-hydrogen exchange,
c) water-hydrogen exchange,

d) water-ammonia exchange,
e) cryogenic distillation of hydrogen,
f) ammonia distillation,
g) water distillation,
h) water electrolysis.

18. Production and processing of other materials with specific nuclear applications, such as nuclear byproduct materials, nuclear-grade graphite, high-strength aluminum alloys, beryllium, boron enriched in boron-10, hafnium, high-strength titanium alloys, low-hafnium zirconium, and helium-3; high purity bismuth, calcium, and magnesium.

19. Safeguards and physical security information and techniques, including modeling systems and procedures, that are unique to or primarily developed for the protection of nuclear weapons and their related design and production facilities, nuclear reactors, and other nuclear fuel cycle facilities, *for example*:
a) design characteristics of barriers,
b) information on tamper-resistant and tamper-indicating devices,
c) physical security measures used by DOE facilities.

Part II: Topics Related to Rockets, Missiles, and Delivery Systems

The following subject areas and related technologies may contain "sensitive" information. Such information may pertain to the research, design, development, testing, manufacture, production, or use of items below and their associated processes, materials, equipment, components, parts, accessories, and software. The lists provided are *illustrative* only and should *not* be considered exhaustive. Additional information regarding these subject areas can be found in the Department of Commerce Export Administration Regulations (15 CFR Parts 730-774) and the Department of State International Traffic in Arms Regulations (22 CFR Parts 120-130).

1. Missiles and rocket systems and subsystems, *for example*:
a) engines, propulsion components, and equipment;
b) propellants and their constituent chemicals (including certain polymers and finely powdered metals);
c) structural materials, including fiber matrices, maraging steel, ceramic composites, and tungsten and molybdenum alloys;
d) pyrolytic deposition/densification equipment;
e) reentry vehicles (e.g., heat shields, heat sinks, and electronics);
f) integrated flight instrument systems, including direction finding equipment and systems, gyrostabilizers, and accelerometers;
g) specially designed software for modeling, simulation, or design integration of the systems;
h) controlled equipment, including flow forming machines, filament winding machines, mixers, milling machines, and other equipment used to produce rocket and missile parts or materials;
i) weapon or warhead safing, arming, fusing, and firing mechanisms.

2. Navigation and avionics equipment, *for example*:
a) radar and laser radar systems,
b) Global Positioning System (GPS) or similar satellite receivers,
c) mapping and imaging equipment,
d) interferometer equipment.

3. Flight control systems and technology, *for example*:
a) telemetering equipment;
b) telecontrol equipment.

4. Launch vehicles, launch support equipment, facilities, and software.

5. Ruggedized or radiation-hardened analog computers, digital computers, digital differential analyzers, analog-to-digital converters or any radiation hardened components including microelectronics or microsystems.

6. Test facilities and test equipment, *for example*:
a) vibration test systems,
b) wind-tunnels, and environmental and anechoic chambers,
c) electromagnetic pulse testing equipment.

7. Stealth technology, including structural materials and coatings specially designed for reduced radar reflectivity, software, and specially designed radar cross section measurement systems.

8. Protection systems for radiation and thermal shock.

Part III: Topics Related to Conventional Arms and Other Defense-Related Technologies

The following subject areas and related technologies may contain "sensitive" information. Such information may pertain to the research, design, development, testing, manufacture, production, or use of items below and their associated processes, materials, equipment, components, parts, accessories, and software. The lists provided are *illustrative* only and should *not* be considered exhaustive. Additional information regarding these subject areas can be found in the Department of Commerce Export Administration Regulations (15 CFR Parts 730-774) and the Department of State International Traffic in Arms Regulations (22 CFR Parts 120-130).

1. Firearms, artillery projectors, and ammunition, *for example*:
a) arms up to .50-caliber, guns over .50-caliber;
b) mortars, howitzers, flame-throwers;
c) cartridge cases, bullets, shells.

2. Other conventional munitions, *for example:*
a) torpedoes,
b) bombs,
c) mines,
d) non-nuclear warheads.

3. Explosives, propellants, incendiary agents, military pyrotechnics, fuel-air explosives, and their constituents.

4. Naval warfare vessels, military vehicles, and aircraft, *for example*:
a) submarines or amphibious vessels;
b) tanks or armored vehicles;
c) military aircraft and helicopters;
d) submersible vessels, oceanographic vessels and equipment;
e) catapults, and turret and gun mounts.

5. Military training equipment, *for example*:
a) flight simulators,
b) radar training equipment.

6. Protective personnel equipment, *for example*:
a) body armor,
b) pressure suits.

7. Military electronics, *for example*:
a) equipment used for countermeasures;

b) radar systems;
c) underwater sonar;
d) command, control, and communications equipment;
e) military computer hardware, software, and system vulnerabilities.

8. Computer chip manufacturing (e.g., lithography).

9. Fire control, range finder, optical guidance, and control equipment, *for example*:
a) gun and missile tracking and guidance systems,
b) night sighting equipment,
c) inertial platforms and sensors for weapons.

10. Auxiliary military equipment, *for example:*
a) directed energy weapons,
b) self-contained diving and underwater swimming apparatus,
c) liquid oxygen converters,
d) concealment and deception equipment,
e) cameras and equipment for imagery analysis.

11. Information security, *for example*:
a) cryptographic systems,
b) encryption/decryption hardware and software,
c) firewall hardware and software.

12. Satellites and spacecraft systems, *for example*:
a) remote sensing satellite systems,
b) global positioning systems,
c) radiation hardened microelectronics,
d) ground control and support equipment,
e) military communication satellites.

13. Mine-sweeping equipment and components.

14. Technologies pertaining to laser defense weapons, *for example*:
a) information on codes or algorithms that could be applied to pointing and tracking accuracy,
b) information on new technologies that would greatly reduce cost or technical difficulty in manufacturing laser weapons.

15. Remote sensing technologies including instrument and detector technologies that may greatly enhance national technical means.

16. Large space-based optics that may be used for remote space-based reconnaissance, target designation, or beam weapon direction.

17. Computer codes capable of modeling high explosive detonations, *for example*:
a) Autodyn,
b) LSDyna,
c) Abaqus,
d) TOPAZ

18. Any article not related to subject areas 1-17 that has substantial military applicability.

Part IV: Topics Related to Chemical and Biological Weapons

The following subject areas and related technologies may contain "sensitive" information. Such information may pertain to the research, design, development, testing, manufacture, production, or use of items below and their associated processes, materials, equipment, components, parts, accessories, and software. The lists provided are *illustrative* only and should *not* be considered exhaustive. Additional information regarding these subject areas can be found in the Department of Commerce Export Administration Regulations (15 CFR Parts 730-774) and the Department of State International Traffic in Arms Regulations (22 CFR Parts 120-130).

1. Chemical or biological agents and their precursors, for example:
a) chemicals enumerated in EAR and ITAR such as, binary chemical agents; blister (vesicant), choking, blood, and nerve agents; and incapacitating agents including psychochemicals, tear gas agents, and vomiting agents;
b) all viruses, bacteria, rickettsiae, toxins, fungi and genetically modified microorganisms as enumerated in the control lists of the EAR and ITAR.

2. Research, techniques, and specialized equipment specific to chemical or biological agents, *for example:*
a) genome sequences and databases;
b) genetic engineering techniques,
c) enhanced lethality.

3. Manufacturing facilities, equipment, and processes for the production of chemical agents, *for example:*
a) reaction vessels, reactors, or agitators;
b) storage tanks, containers, or receivers;
c) heat exchangers or condensers;
d) distillation or absorption columns;
e) remotely operated filling equipment;
f) valves;
g) multi-walled piping;
h) pumps;
i) incinerators.

4. Manufacturing facilities, equipment, and processes for the production of biological agents, *for example:*
a) complete containment facilities at P3, P4 containment level,
b) fermenters,
c) centrifugal separators,
d) cross-flow filtration equipment,
e) freeze-drying equipment,
f) equipment that incorporates or is contained in P3 or P4 (BL3, BL4, L3, L4) containment housing,
g) aerosol challenge testing chambers.

5. Processes, components, and integration of individual components for the weaponization of chemical or biological agents.

6. Delivery and agent dispersal systems for chemical and biological agents, *for example:*
a) artillery projectiles,
b) bombs,
c) rockets,
d) missiles,
e) spray tanks,
f) land mines,
g) grenades,
h) submunitions,
i) information relative to vulnerabilities or effectiveness.

7. Defenses against, and vulnerabilities to, the use of chemical or biological agents, *for example:*
a) vaccines, antitoxins,
b) equipment including protective clothing.

8. Scenarios and models of threats that reveal vulnerabilities and defensive weaknesses.

9. Detection or identification of chemical or biological agents, *for example*:
a) specific signatures that could be used to detect or identify biological or chemical agents or weapons and the facilities used to produce them;
b) details of sensors or sensor systems, including data and analyses, that would substantially reveal their performance characteristics;
c) details of laboratory analysis techniques that would substantially reveal their ability to identify chemical or biological agents.

Part V: Topics Related to Advanced Scientific Computers and Software

The following subject areas and related technologies may contain "sensitive" information. Such information may pertain to the research, design, development, testing, manufacture, production, or use of items below and their associated processes, materials, equipment, components, parts, accessories, and software. The lists provided are *illustrative* only and should *not* be considered exhaustive. Additional information regarding these subject areas can be found in the Department of Commerce Export Administration Regulations (15 CFR Parts 730-774) and the Department of State International Traffic in Arms Regulations (22 CFR Parts 120-130).

1. Advanced high-performance computing technology, *for example*:
a) design or development of computers that meet or exceed the MTOP[2] limit specified for Tier 3 countries in section 742.12 of the EAR,
b) design or development of networks of modular computers that collectively meet or exceed the MTOP limit specified for Tier 3 countries in section 742.12 of the EAR, including their processors and the interconnect switching technology.
2. Source code for massively parallel or clustered computers covered by 1a or 1b above including system management and operating software and compilers.

Part VI: Topics Related to Business Sensitive (Proprietary) Information

Some information not related to military, proliferation, or terrorist areas of concern requires protection because the subject areas are business sensitive (proprietary) and prime targets for economic espionage. The Department of Energy works jointly with U.S. industry so that DOE-developed technology may be transferred to industry for eventual commercialization. Therefore, DOE sponsored work with industrial partners may involve technology at a production or near-production level with considerable commercial value. Work with industrial partners (referred to as cooperative industrial research) is generally in the form of Cooperative Research and Development Agreements (CRADAs) or work-for-others (funds-in-agreements).

This section only applies to information that is not covered by Parts I – V of this list and that is to be shared with a DOE or DOE contractor foreign national. The industrial partner is responsible for screening technologies developed by the partner and for controlling access of information to its employees. Access to business sensitive (proprietary) information by foreign national employees of a DOE industrial partner is covered by their company's internal procedures. If an export license is not required, it is strictly the company's determination as to whether information will be shared commercially with their foreign national employees. DOE must identify export-controlled information generated prior to or during the partnership

[2] Million Theoretical Operations per second, a calculated theoretical value of computer performance.

before further dissemination. This applies to both the information generated by the company as well as to the information developed by DOE for the partnership.

Thus, cooperative industrial research that is not sensitive under Parts I – V of this list will only be considered sensitive if, in the opinion of a DOE industrial partner, it is business sensitive and a significant industrial espionage target.

Part VII: Information and Assistance

The following references, while not an inclusive list, provide sources of information regarding these subject areas and the transfer of information:

Department of Commerce Export Administration Regulations (15 CFR Parts 730-774)

Nuclear Regulatory Commission regulations (10 CFR Part 110)

Department of Energy regulations (10 CFR Part 810)

Department of State International Traffic in Arms Regulations (22 CFR Parts 120-130)

Nuclear Suppliers Group (NSG) Trigger List (IAEA INFCIRC/254/Rev 4/Part 1)

Nuclear Suppliers Group (NSG) Dual-Use List (IAEA INFCIRC/254/Rev 4/Part 2)

Missile Technology Control Regime (MTCR) Equipment and Technology Annex

Australia Group Control Lists:
- Animal Pathogens
- Plant Pathogens
- Biological Agents for Export Control
- Biological Equipment
- Chemicals: Commercial and Military Application
- Chemical Manufacturing Facilities and Equipment, and Related Technology

Privacy Act of 1974, S.U.S.C. 52a

Freedom of Information Act of 1966, 5 U.S.C. 552

National Competitiveness Technology Act of 1989 1 S.U.S.C. 3701

Economic Espionage Act of 1996

NSDD-189: National Policy on the Transfer of Scientific, Technical and Engineering Information

As a reminder, the subject lists provided are *illustrative* only and should *not* be considered exhaustive. A totally comprehensive, complex-wide list of sensitive subjects is difficult to identify and keep current. Consult the export control compliance officer at your site for specific guidance. In addition, each site may develop a detailed, specific list of sensitive technologies in use at the site. Such site-specific lists can be topic and project specific and easily modified as site programs and missions change. Sites and field office personnel should be aware, however, that site-specific lists will be recognized only at the originating site; DOE Headquarters will continue to recognize only the Sensitive Subjects List.

Foreign travelers and hosts of foreign nationals should contact their site's export compliance manager, export control training office, or designated technical experts for further assistance.